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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/620,083	07/15/2003	Hidetomo Nagahara	10407-55US (A3051MT-US1)	7402

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AKIN GUMP STRAUSS HAUER & FELD L.L.P.
ONE COMMERCE SQUARE
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PHILADELPHIA, PA 19103-7013

EXAMINER	
DOUGHERTY, THOMAS M	

ART UNIT	PAPER NUMBER
2834	

DATE MAILED: 04/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/620,083	NAGAHARA ET AL.	
	Examiner	Art Unit	
	Thomas M. Dougherty	2834	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) *17-29* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1,2,4,6-10,13,15 and 16* is/are rejected.

7)☐ Claim(s) *3,5,11,12 and 14* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *703*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 4, 7, 9, 10, 15 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Erikson (US 4,281,550). Erikson shows (fig. 9) a composite piezoelectric transducer comprising: a plurality of arranged piezoelectric elements (630); and dielectric portions (620) positioned between the plurality of piezoelectric elements (630), wherein an area of a cross-section perpendicular to an ultrasonic emitting direction in at least one piezoelectric element of the plurality of piezoelectric elements varies along the ultrasonic emitting direction. Note that they widen from the top electrode (610) to the bottom electrode (605).

Each of the plurality of piezoelectric elements (630) has a size in a certain direction perpendicular to the ultrasonic emitting direction, the size being fixed along the ultrasonic emitting direction.

The plurality of piezoelectric elements (630) have a substantially uniform height.

An area of a cross-section perpendicular to an ultrasonic emitting direction of at least one of the plurality of piezoelectric elements in an end face (the bottom end face, bound by electrode 605) of the piezoelectric element (630) is larger than the area in a center of the piezoelectric element.

An area of a cross-section perpendicular to an ultrasonic emitting direction of at least one of the plurality of piezoelectric elements (630) in an end face of the piezoelectric element is smaller than the area in a center of the piezoelectric element (630). Note that the emitting surfaces represent the narrower of generally parallel surfaces of the trapezoidally shaped piezoelectric elements.

The dielectric portion (620) is formed from a resin. See col. 6, lines 25-26.

A modulus of elasticity of the resin has a predetermined distribution (between and atop of the piezoelectric elements) in accordance with positions of the piezoelectric elements in a plane perpendicular to the ultrasonic emitting direction.

Claims 1, 2, 4, 6, 7-10, 13, 15 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Esashi et al. (US 6566,265). Esashi et al. show (figs. 4 and 10B) a composite piezoelectric transducer comprising: a plurality of arranged piezoelectric elements (1 or 61); and dielectric portions (2) positioned between the plurality of piezoelectric elements (61), wherein an area of a cross-section perpendicular to an ultrasonic emitting direction in at least one piezoelectric element of the plurality of piezoelectric elements varies along the ultrasonic emitting direction. Note that they widen from the bottom electrode (39) to the top electrode (also 39).

The individual piezoelectric elements (1 or 61) have varying cross sections in a length direction wherein at least one piezoelectric element has a resonance frequency which is different from resonance frequencies of the other piezoelectric elements.

Each of the plurality of piezoelectric elements (61) has a size in a certain direction perpendicular to the ultrasonic emitting direction, the size being fixed along the ultrasonic emitting direction.

The plurality of piezoelectric elements (1, 61) are two-dimensionally arranged along a plane perpendicular to the ultrasonic emitting direction of the piezoelectric elements, and resonance frequencies of the plurality of piezoelectric elements are varied depending on the positions thereof in the plane. See especially figure 4.

The plurality of piezoelectric elements (1, 61) have a substantially uniform height.

Resonance frequencies of the piezoelectric elements (1, fig. 4) in a peripheral portion of a plane perpendicular to the ultrasonic emitting direction of the piezoelectric elements are lower (note that emitting surfaces are larger) than resonance frequencies of the piezoelectric elements in a center portion of the plane.

An area of a cross-section perpendicular to an ultrasonic emitting direction of at least one of the plurality of piezoelectric elements in an end face (the bottom end face, bound by bottom electrode) of the piezoelectric element (61) is larger than the area in a center of the piezoelectric element.

An area of a cross-section perpendicular to an ultrasonic emitting direction of at least one of the plurality of piezoelectric elements (61) in an end face of the piezoelectric element is smaller than the area in a center of the piezoelectric element (61). Note that the emitting surfaces represent the narrower of generally parallel surfaces of the trapezoidally shaped piezoelectric elements.

Shapes of the plurality of piezoelectric elements (1, 61) are selected so that resonance frequencies of the plurality of piezoelectric elements (1, 61) have a predetermined distribution in plane. This is evident in figure 4.

The dielectric portion (2) is formed from a resin. See col. 19, lines 63-66.

A modulus of elasticity of the resin has a predetermined distribution (between the piezoelectric elements) in accordance with positions of the piezoelectric elements in a plane perpendicular to the ultrasonic emitting direction.

Claims 1, 4, 7, 9 and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Bast et al. (US 5,164,920). Bast et al. show (fig. 1) a composite piezoelectric transducer comprising: a plurality of arranged piezoelectric elements (12); and dielectric portions (11) positioned between the plurality of piezoelectric elements (12), wherein an area of a cross-section perpendicular to an ultrasonic emitting direction in at least one piezoelectric element of the plurality of piezoelectric elements varies along the ultrasonic emitting direction.

Each of the plurality of piezoelectric elements (12) has a size in a certain direction perpendicular to the ultrasonic emitting direction, the size being fixed along the ultrasonic emitting direction.

The plurality of piezoelectric elements (12) have a substantially uniform height.

An area of a cross-section perpendicular to an ultrasonic emitting direction of at least one of the plurality of piezoelectric elements in an end face (the bottom end face) of the piezoelectric element (12) is larger than the area in a center of the piezoelectric element (12).

An area of a cross-section perpendicular to an ultrasonic emitting direction of at least one of the plurality of piezoelectric elements (12) in an end face of the piezoelectric element is smaller than the area in a center of the piezoelectric element (12). Note that the emitting surfaces represent the narrower of generally parallel surfaces of the trapezoidally shaped piezoelectric elements.

Claims 1, 4, 7, 9 and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Ohara et al. (JP 02-051289). Ohara et al. show (fig. 6) a composite piezoelectric transducer comprising: a plurality of arranged piezoelectric elements (11); and dielectric portions (5) positioned between the plurality of piezoelectric elements (11), wherein an area of a cross-section perpendicular to an ultrasonic emitting direction in at least one piezoelectric element of the plurality of piezoelectric elements varies along the ultrasonic emitting direction.

Each of the plurality of piezoelectric elements (11) has a size in a certain direction perpendicular to the ultrasonic emitting direction, the size being fixed along the ultrasonic emitting direction.

The plurality of piezoelectric elements (11) have a substantially uniform height.

An area of a cross-section perpendicular to an ultrasonic emitting direction of at least one of the plurality of piezoelectric elements in an end face (the bottom end face) of the piezoelectric element (11) is larger than the area in a center of the piezoelectric element (11).

An area of a cross-section perpendicular to an ultrasonic emitting direction of at least one of the plurality of piezoelectric elements (11) in an end face of the

piezoelectric element is smaller than the area in a center of the piezoelectric element (11). Note that the emitting surfaces represent the narrower of generally parallel surfaces of the trapezoidally shaped piezoelectric elements.

Allowable Subject Matter

Claims 3, 5, 11, 12 and 14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance: The prior art fails to show or fairly suggest in a structure of piezoelectric elements embedded in resin a limitation wherein the resonance frequencies of the plurality of piezoelectric elements have a distribution in which a difference between the minimum value and the maximum value is equal to or more than 10 % of a mean value. Also not shown nor fairly suggested in such a structure is each of the plurality of piezoelectric elements having a pair of columnar portions extending in the ultrasonic emitting direction, and a thickness of a bridging portion for coupling the columnar portions in the middle thereof is varied in a plane perpendicular to the ultrasonic emitting direction of the piezoelectric elements. Also not shown nor fairly suggested by the prior art in such a structure is a limitation wherein each of the plurality of piezoelectric elements has an opening portion in the center thereof, and a size of the opening portion is varied in a plane perpendicular to the ultrasonic emitting direction of the piezoelectric elements. Also not shown nor fairly suggested in such a structure are limitations wherein or wherein a ratio of a size in the

ultrasonic emitting direction of the piezoelectric element to the minimum size S of a cross-section perpendicular to the ultrasonic emitting direction of the piezoelectric element is 5 or more.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Any remaining prior art cited reads on at least some aspects of the claimed invention.

Direct inquiry to Examiner Dougherty at (571) 272-2022.

tmd

March 9, 2005

TOM DOUGHERTY
PRIMARY EXAMINER